

Image Reconstruction and Source Extraction for TPF-I: A Gaussian Plus Positivity Algorithm

Thangasamy Velusamy and Ken A. Marsh

(Email: Thangasamy.Velusamy@jpl.nasa.gov)

Jet Propulsion Laboratory, Pasadena, California

We have developed an algorithm based on *Richardson and Marsh* (1983) to reconstruct an image from the sin/cos chopped output of a dual-nulling interferometer. This algorithm treats the ensemble of possible images as a Gaussian random process subject to a positivity constraint, and contains no limitations on the presence of negative lobes in the null response pattern with the chop. The Bayesian procedure maximizes the probability density of the image, conditioned on the data. The input is a time series of the sin/cos chopped output intensities along with their corresponding null responses. We present examples of image reconstruction using the simulated data for multiple planet cases for dual Bracewell nulling configurations on: 1) a 36-m baseline Structurally Connected Interferometer (SCI); and 2) a 72-m baseline Free Flyer Interferometer. For planet signal extraction, by incorporating the additional piece of prior knowledge that the true image is dominated by point sources, one can employ the same basic methodology to estimate the most probable set of point sources in a way that combines the measurements at all wavelengths simultaneously. The algorithm is also applicable for general astrophysical imaging with TPF-I.

-
- [a] Richardson, J.M., and Marsh, K.A., Probabilistic Approach to the Inverse Problem in the Scattering of Elastic and Electromagnetic-waves, *Proc. Soc. Photo-Optical Instr. Eng. (SPIE)*, **413**, 79-87, 1983.

